

Macro Academic Course Descriptions

Macro 410 – Design and Applications of Biomaterials (Fall Term)

Biomaterials and their physiological interactions. Materials used in medicine/dentistry: metals, ceramics, polymers, composites, resorbable, smart natural materials. Material response/degradation: mechanical breakdown, corrosion, dissolution, leaching, chemical degradation, wear. Host responses: foreign body reactions, inflammation, wound healing, carcinogenicity, immunogenicity, cytotoxicity, infection, local/systematic effects.

Macro 412 – Polymeric Materials (Fall Term)

The synthesis, characterization microstructure, rheology, and processing of polymeric materials. Polymers in solution and in the liquid, liquid-crystalline, crystalline, and glassy states. Engineering and design properties including viscoelasticity, yielding, and fracture. Forming and processing methods. Recycling and environmental issues.

Macro 512 – Polymer Physics (Winter Term)

Structure and properties of polymers as related to their composition, annealing and mechanical treatments. Topics include creep, stress relaxation, dynamic mechanical properties, viscoelasticity, transitions, fracture, impact response, dielectric properties, permeation, and morphology.

Macro 514 – Composite Materials (Winter Term)

Behavior, processing, and design of composite materials, especially fiber composites. Emphasis is on the chemical and physical processes currently employed and expected to guide the future development of technology

Macro 517 – Mechanics of Polymers (Every other Winter term, next offered WN 2016)

Viscoelastic stress-strain relations; generalized creep and relaxation models, operational approach. Correspondence between viscoelastic and elastic solutions of boundary value problems. Three dimensional theory of linear viscoelastic media. Quasi-static problems; sinusoidal oscillation problems; use of complex modulus and compliance; dynamic problems, impact.

Macro 518 – Organometallic Chemistry (Every other Winter term, next offered WN 2017)

Systematic consideration of modern aspects of organometallic chemistry including main group and transition metal complexes. The structure and bonding in organometallic compounds are covered. Particular emphasis is placed on applications of homogeneous organometallic catalysis in polymer synthesis, industrial processes, and synthetic organic chemistry.

Macro 530 – Advanced Functional Polymers: Molecular Design & Applications (Fall Term)

Development of global perspective of interdisciplinary issues involved in functional polymers. Learn how to design, synthesize, evaluate, and analyze functional polymers.

Macro 536 – Polymer Synthesis and Characterization (Every other Winter, next offered WN 2016)

Polymers have revolutionized every material we use over the last 100 years with applications ranging from clothes to construction materials, building materials to balloons, and furniture to medical devices. In this laboratory course, you will learn how to make and characterize polymer samples. The once a week discussion sections will cover polymerization mechanisms, the implications of making macromolecules of tens to hundreds of thousands molecule weight, and the theory behind the characterization techniques. You will learn how to identify polymer materials you encounter. Finally, you will propose new cutting edge polymerization methods to explore and work with your colleagues to carry out the most up-to-date approaches to making new polymeric materials.

Macro 538 – Organic Chemistry of Macromolecules (Winter Term)

The preparation, reactions, and properties of high molecular weight polymeric materials of both natural and synthetic origin.

Macro 559 – Foundations of Nanotechnology (Every other Fall term, next offered FA 2016)

This course will cover the synthesis and processing of nano-sized metal, metal oxide, and semiconductor powders. It will also include organic/inorganic and nanobiomaterials. Emphasis will be on particle properties and their use in making nanostructured materials with novel properties.